JPRS-UCH-88-007
27 APRIL 1988

FOREIGN BROADCAST INFORMATION SERVICE

JPRS Report

Science & Technology

USSR: Chemistry

JPRS-UCH-88-007

27 APRIL 1988

SCIENCE & TECHNOLOGY

USSR: CHEMISTRY

CONTENTS

ELECTROCHEMISTRY

INORGANIC COMPOUNDS

/13046

UDC 541.18

ELECTRON PROBE ANALYSIS OF IODINATION OF HIGHLY DISPERSED SILVER PARTICLES

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 296, No 6, Oct 87
(manuscript received 5 Feb 87) pp 1402-1405

[Article by A.A. Onishchuk, A.V. Bubnov, S.E. Pashchenko, M.N. Dulin, L.S. Lazareva and A.G. Sutugin, Institute of Chemical Kinetics and Combustion, Siberian Department, USSR Academy of Sciences, Novosibirsk]

[Abstract] The reaction of halogens with ultradispersed silver particles ($d \leq 0.01$ μm) is of interest in photography, atmospheric icing etc., but the mechanisms have not been subjected to a detailed analysis to date, with the exception of some studies on reactions involving faces of single silver crystals [Bardi, U., et al., Surf. Sci., 128: 145-168, 1983; Bowker, M., et al., Ibid., 134: 639-664, 1983]. In view of this, an experiment was designed to use Auger electron transmission microscopy to monitor iodination of silver aerosols, a method that provides both Auger spectra of the particles and micrographs. Silver aerosols ($80 \leq d \leq 300$ Å) were iodinated in a flow-through apparatus with iodine vapors at 25°C, with variation of the iodine vapor pressure. Prior to iodination, the silver aerosol was exposed to 400°C for 5 sec to provide the silver in a single crystal form for iodination. Analysis of the spectra indicated that at low iodine vapor pressure ($\leq 10^{-3}$ torr) the initial stages involve the formation of Ag(α) as the pressure is gradually increased. The spectra suggested the formation of a single crystal envelope around a nucleus of Ag. A further increase in iodine vapor pressure leads to Ag(α) → Ag(β) phase transition, with the thickness of the envelope increasing as the Ag nucleus diminishes and disappears. Figures 2; references 8: 5 Russian, 3 Western.

12172/13046
CSO: 18410081

ECONOMIC EFFECTIVENESS OF CHEMICALIZING NATIONAL ECONOMY

Moscow EKONOMIKA I MATEMATICHESKIYE METODY in Russian Vol 23, No 5, Sep-Oct 87 (manuscript received 16 Apr 86) pp 826-834

[Article by I. Ye. Krichevskiy, Moscow]

[Text] Goal-directed comprehensive programs are being ever more extensively used in recent years to improve planning on all levels. In developing and implementing these programs, many unsolved procedural and applied problems have arisen, including the crucial problem of economic substantiation of the goals of the programs, the paths to these goals, and the deadlines for attaining them. And the higher the level of the national economic hierarchy for which they are developed, the more sectors of industry that are directly or indirectly related to them either as consumers or suppliers of resources, or as "competitors," the more complicated will be the economic substantiation of these programs.

Economic substantiation of long-range resource programs is especially intricate. One such program is KP KHIM -- a comprehensive program for chemicalizing the national economy for the period up to the year 2000 [1]. According to [2], KP KHIM is characterized by the following basic features: with respect to goals of socioeconomic development, it is a resource program, as more than 90 percent of the goods produced by the chemical industry are intermediates for the national economy; with respect to the essence of problems addressed by KP KHIM, the program can be categorized as economic or production-economic; KP KHIM is a long-range program; KP KHIM is a program of national economic significance that deals with nation-wide interindustrial and interterritorial problems.

In addition, the program has the following specific features. The quantitative expression of its goals is the direct object of economic substantiation. This expression is the option of alternative paths to the attainment of these goals depending on assigned rates of development either of the chemical industry, or of industries directly or indirectly competing with the chemical industry. Thus, the goals and the means of attaining them have firm mutual feedbacks. The paths to attainment of the goals of the program are characterized by multiple options that increase with time. In virtue of the specifics of production and utilization of chemical goods, the multiple-option aspect is to a great extent conditioned by: the interchangeability of chemical production goods, especially synthetic polymers, with goods of other industries (metals, wood, cement, natural fibers, food products, and the

like), as well as with each other; the possibility of using chemical goods in one way or another to intensify technological processes in other industries (chemicalizing agriculture, utilizing chemical intensification in recovery of minerals), and also the interchangeability among chemical intensifiers themselves; a wide range of technological processes for producing many chemical end products and nearly all intermediates, including the use of different kinds of initial raw materials both separately and in combination.

Because of such wide-ranging interchangeability, identical or similar ultimate national economic results may be reached by different combinations of paces and proportions of the chemical industry and its "competitors" (including their supporting industries), the proportions, and to some extent even the paces of consumer industries of chemical goods.

The more nearly that the paces and proportions of development of the chemical industry approach the optimum, the more appreciable will be the savings of natural, material, and labor resources.

It is the intimate interrelatedness of goals and means of accomplishing them, and the resource-saving nature of the given program that constitute its main difference from other large-scale long-range goal-directed national economic programs: the Food Program, the Consumer Goods and Services Program, and the Fuel and Energy Program. The goals of the first two are directly formed under the influence of social, more than economic tasks aimed at attainment of a reasonable standard of living (reasonable diet, reasonable apparel, and so on). Only the time scales and paths to realization of these goals require economic substantiation.

In development of the Energy Program, the demand for fuel and energy (except for the demand of the energy complex itself) is determined almost unequivocally* by the aim of the higher (national economic) level; the purpose of this program is to find ways to meet the given demand. Thus, economic substantiation of the Energy Program, although an important component, is relatively subordinate in contrast to the chemicalization program.

The goals, deadlines and paths of attainment of KP KHIM are formed nearly simultaneously, and therein lies the complexity of economic substantiation of the program.

Of course, the basis for formation of the given program is a "model" (projection) of the national economic plan for 20 years. It is this tentatively balanced forecast of projection of the plan in a rather modularized form that is the source of quantitative information about the results of meeting the needs of the populace and the national economy that can be attained by alternative utilization of chemical or traditional materials and technology, domestic production, or importation of chemicals. The choice of global and

---

*The sub-program of energy conservation is an exception.

local ratios between conventional and chemical materials by comparing expenditures of resources to minimize consumption leads simultaneously to disclosure of: 1. the goals of the program (economically justified demand of the national economy and its industrial sectors for chemical goods); 2. methods of meeting this demand (program of development of the chemical industry, and foreign trade in chemical goods).

Thus, when figuring the optimum paces and proportions of development of the chemical complex and chemicalization of the national economy, determination of the economic result for the national economy comes to the forefront. If these optimum paces and proportions could be obtained in the course of solving a higher-level problem -- optimizing the paces and proportions of development of the national economy as a whole -- the choice of a criterion functional of the problem would predetermine the proportions of development of the chemical industry. But since the optimization problem on such a high level is as yet unsolved, the criterion functional of the problem of optimizing development of the chemical industry and chemicalization of the national economy must be unidirectional with the national economic criterion functional, and must in large measure correspond with it. In the opinion of many specialists, this goal can be approached if an index of net output be used as the result in economic substantiation of large-scale national economic steps [3, 4] or goal-directed programs [4, 5] with simultaneous use of standards of efficiency of capital investments and labor resources when determining outlays.

In this case, the effect of the program will take the form

$$R = N - (E_i K + E_v V),$$

where N is the net output of the program, R is the economic effect of a step or program, E_i is the standard of efficiency of capital investments, K are the capital investments in the program, E_v is the standard of efficiency of labor resources, and V is the yearly payroll for facilities that come under the program.

However, the standard of efficiency of labor resources has not yet been granted civil legality. Moreover, wholesale prices for goods of different quality (including those manufactured with the use of chemical and traditional materials) and for the materials themselves are set mainly in accordance with a purely cost principle, and do not reflect the effectiveness of ultimate utilization of the goods. Under these conditions, we feel that it is incorrect at this time to use a criterion functional of maximizing net output in its simplest form without adjustment made with consideration of supplemental information about the identity of the final results of utilizing alternative products, and about the structure of resources for producing them (associated capital investments and labor inputs).

At the same time, we feel that the approach to figuring impact and effectiveness by comparing the volume of net output and the standard expenditures of resources is itself quite valid. We have suggested an approach of slightly different form for determining the economic impact and effectiveness of KP KHIM based on the same principles as maximization of net output after

deducting standard expenditures of resources. With respect to economic content, the last indicator is national economic net profit, and we will use it as the critical component of the aggregate national economic effect of implementation of KP KHIM.

The national economic effect of growth of production in the chemical industry and chemicalization of the national economy is made up of four components. The first three are associated with an increase in the volume of production of chemical goods, improvement of output structure, and savings of resources in the chemical complex (they are characterized by the increment in profits), and the fourth is associated with the savings of resources in the national economy as a result of using chemical products in place of traditional products. This component takes the form of the national economic consumer impact, and is an indicator of national economic net profit. We will refer to the sum of the increment in profits realized as a result of development of the chemical complex, including related sectors of industry, and the increment in the effect of using chemical products as the aggregate national economic effect of realization of KP KHIM.

Calculation of the economic effectiveness of KP KHIM should be based on the principle of comparing the aggregate national economic effect due to development of the chemical complex and the use of its products in the national economy, with the capital investments necessary for carrying out the measures of KP KHIM.

The increment in profits in sectors of the chemical complex, including all chemical production, regardless of departmental affiliation, and in related industries as compared with a base year (the last year of the pre-plan period) must be determined in business wholesale prices effective in that year (for 1985, the list prices on 1 January 1982).

Related industries of the chemical complex are considered to be those that supply materials to the chemical complex and that process chemical goods. Among the processing industries is agriculture in the part that provides mineral fertilizers and other chemicals of agricultural purpose (fertilizer mixing enterprises, equipment for delivering and applying fertilizer, and the like); supplying industries include raw materials, fuel and energy, machine building, the construction industry, transport industries, and the like.

Calculation of the economic effect is based on a national economic approach that consists in comparing the expenditures for attaining a result that is the same from a national economic standpoint for alternative use of chemical or traditional goods (technology), a chemical product of different quality or produced from different sources (Soviet or imported product). In this way, the economic effect shows the detriment (gain) to the national economy when natural goods and raw materials are replaced with chemical analogs, when chemical items and materials of lower quality are substituted for their higher-quality counterparts, and so on. Procedural and practical issues of determining the economic effectiveness of using chemical goods in the national economy, including the specifics of such calculations in agriculture, construction, heavy and light industry, have been considered in detail in [6].

The effect of utilizing an irreplaceable chemical product is calculated by comparing expenditures for importing it and for producing it domestically. The effectiveness of exporting a chemical product is determined by comparing the income from sales with the outgo for production. Calculations of the effect compare overhead and capital expenditures on producing an interchangeable product, processing it into finished goods, and also overhead expenses and capital outlays* in the area of operations.

To avoid recomputing the increment in profits of sectors of the chemical complex when determining the overall economic effect of carrying out KP KHIM, calculations should be done with consideration of expenditures on raw materials and items used when producing chemical and interchangeable goods with respect to effective wholesale prices rather than with respect to their prime cost.

The increment in the overall national economic effect due to implementation of KP KHIM is compared with the total capital investments required for these purposes, i. e., the investments in expanded production of the chemical industry and related sectors without expenditures on simple reproduction. The main point here is that the increment in profits and in economic effect due to development of the chemical industry and related sectors does not reflect national economic effects associated with maintaining the production potential of the aforementioned sectors and the resource-saving effect that this potential ensures on the level of the pre-plan period (1985).

Expenditures intended for increasing construction starts for the future beyond the time frame of program implementation, i. e., the difference between the volume of construction in progress in the initial and final year of realization of the program, should be excluded from the total capital investments (only for calculations of the effectiveness of KP KHIM). Another approach is also possible. If the aforementioned expenditures are not excluded from the total capital investments, then the aggregate national economic effect must include the profits and economic effect from goods produced because of this beyond the time frame of program implementation, but corrected for depreciation.

Total capital investments in development of the chemical industry and related sectors are accounted for with respect to the same circle of industries that ensure an increase in profits. The capital investments themselves must be determined in prices of the same period as those for all other material resources. For 1985, there are capital investments in 1984 prices. Both the aggregate national economic effect and the capital investments that yield this

---

*Adjusted to overhead expenses. If in future it should be officially recommended that expenditures of live labor also be taken into consideration when accounting for expenditures of production resources, then they will have to be calculated by standards E_v as well, preferably with maximum approach to their total expenditures.

effect are integrally calculated, i e., with respect to the sum of all years of KP KHIM implementation. Such an approach enables more complete comparison of expenditures and results than conventional determination of the time for recovery of capital investments, where their value for the entire plan period is divided by the increment in the effect only in its last year. The traditional approach can be used without a large error to determine effectiveness for a period of up to five years. When comparing long-range programs for ten years or more, (KP KHIM is being developed for 15-20 years), a considerable role is played by accounting for the time factor, as capital investments of the first five-year period are responsible in large measure for economic results in subsequent periods.

It is advisable to compare the integral aggregate national economic effect to capital investments throughout the period of program implementation with allowance for the time factor, i. e., to the investments normalized to a single time by using a discounting factor. This index characterizes the national economic effectiveness of the proposed version of the program.

Comparison of the total aggregate economic effect due the increment in production and consumption of chemical goods in the national economy for the period of implementation of KP KHIM with the capital investments that have caused this effect shows by how many times the magnitude of the effect for these years exceeds expenditures.

Along with the generalized index of economic effectiveness of KP KHIM, the economic effect of carrying out this program is also shown by special indicators. Among these is economy of global and local resources. The former cover capital investments and labor resources, and the latter subsume fuel, in particular petroleum, ferrous and nonferrous metals, wood, cement, natural fibers (including cotton, wool, flax) and so on. Determination of each of them has its own specifics, but there are some general principles: comparing complete or nearly complete expenditures of the aforementioned resources for satisfying the demands of the national economy by using chemical or traditional materials (technologies), chemical products of different qualities or types. In doing so, consideration is taken of expenditures of resources not only for production of an equivalent amount of alternative materials with regard to quality and service life of the items produced by using them, but also their consumption during use (servicing, repair, and so on).

The economy of individual kinds of resources is determined by the increment in production of the chemical end product for the last year of each five-year period within the time frame of program implementation as compared with the last year of the pre-plan (pre-program) period. Integrated calculation of the economy of resources is also possible, but their value is not depreciated with time.

Tentative calculations of the economic effect of implementing KP KHIM up to the year 2000 that have been done under the procedural guidance of the author and with his participation have shown that capital investments in carrying out all measures of the program (without expenditures on maintaining capacities effective during the base period) will yield an integrated national economic

effect 1.7-1.8 times the complete capital investments. In this regard, the increment in profits for the given period alone will pay back investments for implementing the program, and the economic effect for consumers will be the net economic gain for the national economy. These calculations were based on the accelerated paces of development of the chemical complex assumed in KP KHIM (in the maximum version 6.3 percent per year*) and expert distribution of the chemical end product with respect to consumer industries.

Fig. 1. Effectiveness of chemicalization, billions of rubles: solid line -- aggregate national economic effect; dashed line -- total capital investments

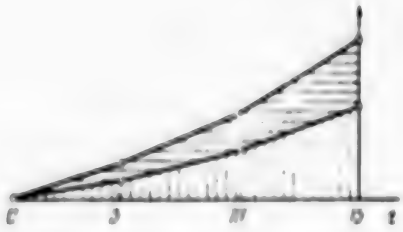

Fig. 2. Structure of aggregate national economic effect of the comprehensive program for chemicalizing the national economy, percent: upper section -- economic effect; lower section -- profit

Fig. 1 shows the dynamics of the aggregate national economic effect over the period of implementation of the comprehensive program, and the resources required for these purposes. During the first five-year plan, total capital investments are somewhat greater than the increment in economic effect (by a factor of roughly 1.5). During the second five-year plan, and especially during the third, capital investments fall below the economic effect by 30 and 65 percent respectively, and over the 15 year period are only 3/5 of its value. The percentage of profit in the aggregate effect continuously declines, while in the economic effect it increases from 51 percent in the first

*As a result, the percentage of the chemical industry in the overall volume of the gross output of industry for 15 years should be raised from 6.3 to 8.0 percent.

five-year plan to 53 percent in the second, and to 56 percent in the third (see Fig. 2).

Among the various groups of chemical end products, mineral fertilizers and other chemicals destined for agriculture (Table) make the greatest contribution to formation of the aggregate economic effect (≈½). Second place goes to

Percentage of various groups of chemical end products in the aggregate national economic effect and in the expenditure of resources for the program as a whole

Group of chemical end products	In national economic effect	In capital investment
Plastics	13.5	14.5
Chemical fibers	20.4	10.3
Tires and rubber goods	17.4	7.8
Mineral fertilizers and agricultural chemicals	24.1	33.0

chemical fibers (with destinations outside the chemical complex) which make up ≈1/5 of the total. If allowance is made for chemical fibers that go into production of tires and rubber goods, the percentage of this group will exceed that of chemical goods for agriculture. In third place are items for the tire and rubber goods industry, the latter making the greater contribution to the total effect. Plastics are a significant fraction of the effect, although in fourth place with respect to this index.

These groups are arranged somewhat differently with respect to the percentage of utilization of capital investments intended for the comprehensive program (Table). Chemical products of agricultural purpose still come in first, with plastics in second place, chemical fibers third, and tires and rubber goods fourth. As a result, the output of the tire and rubber goods industry is characterized by the greatest economic effectiveness in the comprehensive program of chemicalization of the national economy, the aggregate effect from production and use of this output being nearly four times the total capital

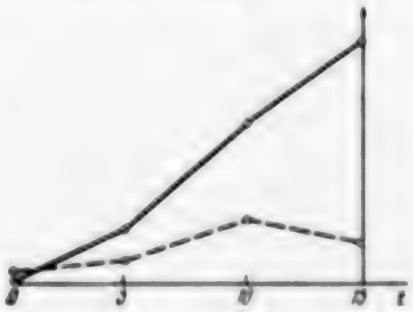

Fig. 3. Effectiveness of producing and using plastics, billions of rubles: solid line -- aggregate national economic effect; dashed line -- total capital investments

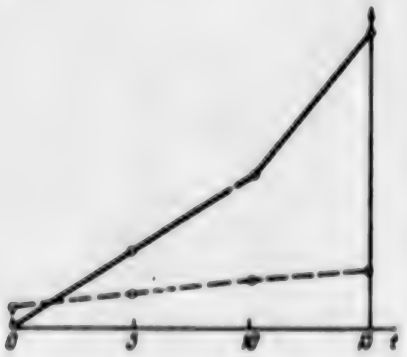

Fig. 4. Effectiveness of producing and using chemical fibers, billions of rubles: solid line -- aggregate national economic effect; dashed line -- total capital investments

investments needed for developing these sectors (Fig. 3). Second place with respect to this index goes to chemical fibers destined for use outside the chemical complex, with an effect 3.5 times the capital investments (Fig. 4). Plastics come in third with a coefficient of 1.7 (Fig. 5). The lowest coefficient of 1.3 goes to agricultural chemical products (Fig. 6).

Fig. 5. Effectiveness of producing and using plastics, billions of rubles: solid line -- aggregate national economic effect; dashed line -- total capital investments

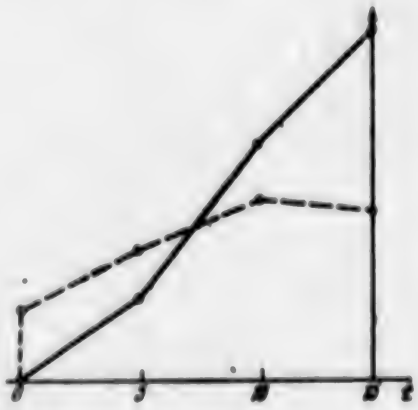

Fig. 6. Effectiveness of producing and using fertilizers and other agricultural chemicals, billions of rubles: solid line -- aggregate national economic effect; dashed line -- total capital investments

The greatest effectiveness is given by renewal of fixed capital in the chemical industry, i. e., capital investments in simple production. Calculations have shown that capital investments that allow the production and use of chemical end products to be maintained on the 1985 level for the next 15 years comprise only 20 percent of the aggregate national economic effect, and the aggregate national economic effect is five times the total capital investments required for these purposes. The first reason for this is that simple reproduction involves renewal of chiefly only the active part of fixed capital. Another reason is that chemical production now in operation supports

the most effective areas of application of its end products (mineral fertilizers for commercial crops, substitution of plastics for nonferrous metals, and displacement of natural fibers by chemical fibers in the tire, woolen, and knitted goods industries).

Implementation of KP KHIM in full volume for 15 years will enable considerable savings of traditional mass materials. The savings of ferrous metals should be roughly a third of their current yearly production, and the savings of scarce and costly nonferrous metals will exceed the current yearly output of plastics. The volume savings of wood materials will roughly equal their current yearly output, and more than 60 million extra metric tons of cement will be made available in the building industry. The savings of natural fibers, chiefly cotton, will be equivalent to a three-year production volume. Roughly 3 million workers will be made available by the increased production and use of chemical fibers, plastics and mineral fertilizers alone in the last year of implementation of KP KHIM.

The proposed approach to determining the economic effectiveness of KP KHIM is rather complicated to use in practice in full measure as the criterion functional in the problem of optimizing development of the chemical industry and distribution of its end products. The reason is that it is difficult to determine with high precision in each version the total capital investments in development of the chemical industry of a sector, and the profit over the entire network of these sectors. Therefore, it is necessary to find as the criterion functional of the aforementioned problem an indicator that accounts for at least the magnitude of the national economic effect of using chemical end products, and the size of the profit with respect to the process stages of all chemical facilities that are part of the chemical complex. Such a criterion functional has already been suggested by workers at TsEMI and has been used to solve the problem of optimizing development first of the polymer-petrochemical complex [7], and then that of the polymer-petrochemical-petroleum complex [8] that subsumes a considerable part of the entire chemical industry. The essence of this criterion functional is in the search for the maximum difference between the magnitude of the transformed national economic effect of using the end products of the complex, and the expenditures on producing them. The effect is transformed as follows. The wholesale price for the chemical material is added to the economic effect due to using each chemical product for each consumer as calculated by using wholesale prices for chemical and alternative traditional materials. Thus, the transformed effect contains two components: the economic effect itself, and the cost of the end product. Solution of the optimization problem with the criterion functional of maximizing the difference between the overall transformed effect of using the end products of a complex and the total expenditures on producing its entire output yields the aggregate national economic effect. It consists of the national economic impact of using the end product, and the profit from production of all chemical goods included in the product list of end products and intermediates being optimized. Profit is included in this quantity because overhead expenditures on all kinds of goods (end products and intermediates) enter into the solution with respect to the production cost of process stages, rather than with respect to wholesale prices. Hence, this criterion

functional can be used to optimize the program of chemicalizing the national economy and development of the chemical industry.

KP KHIM considers only general trends in development of the chemical complex and chemicalization of sectors of economics that will be more precisely defined and pinned down in the development of long-range and five-year plans. It is therefore deemed advisable to use the index of the aggregate national economic effect when substantiating the outlook for development of individual sectors of the chemical industry, multiple-sector chemical complexes, and the chemical industry as a whole, and also to look at the possibility of using this index or its components as a criterion functional for problems of long-range development of the chemical industry and its sectors.

REFERENCES

1. "Kompleksnaya programma khimizatsii narodnogo khozyaystva SSSR na period do 2000 goda" [Comprehensive Program of Chemicalization of the National Economy of the USSR for the Period up to the Year 2000], Moscow, Politizdat, 1985.
2. "Problemy razrabotki i realizatsii kompleksnykh programm" [Problems in Developing and Implementing Comprehensive Programs], Moscow, Nauka, 1984.
3. L'vov, D. S., Mikerin, G. I., "Impact of Scientific and Technical Progress on Effectiveness and Intensification of Social Production], VESTNIK AKADEMII NAUK SSSR, No 3, 1985.
4. L'vov, D. S., Mikerin, G. I., "National Economic Effectiveness of Scientific and Technical Progress, and its Mutual Relation to Socioeconomic Development" in: "Otsenka sotsialno-ekonomicheskoy effektivnosti nauchno-tekhnicheskogo progressa na raznykh urovnyakh upravleniya ekonomikoy" [Assessment of Socioeconomic Effectiveness of Scientific and Technical Progress on Different Levels of Management of the Economy], Moscow, TsEMI, USSR Academy of Sciences, 1980.
5. "Problemy razrabotki i realizatsii kompleksnykh programm," Moscow, Nauka, 1984.
6. "Effektivnost khimizatsii narodnogo khozyaystva" [Effectiveness of Chemicalization of the National Economy], Moscow, Khimiya, 1977.
7. "Optimizing Development of a Complex of Sectors of the Chemical Industry," ZHURNAL VSESOYUZNOGO KHIMICHESKOGO OBSHCHESTVA IMENI D. I. MENDELEYEVA, Vol 22, No 2, 1977.
8. "Procedural and Practical Problems of Optimizing Development of the Polymer-Petrochemical-Petroleum Complex," EKONOMIKA I MATEMATICHESKIYE METODY, Vol 16, No 1, 1980.

6610
CSO 18410125

UDC 541.124:66.023

DYNAMICS OF CHEMICAL PROCESSES AND REACTORS: REVIEW

Ivanovo IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: KHIMIYA I KHIMICHESKAYA TEKHNOLOGIYA in Russian Vol 30, No 8, Aug 87 (manuscript received 23 Dec 85) pp 3-12

[Article by V.S. Beskov, Chair of General Chemical Technology, Moscow Institute of Chemical Technology imeni D.I. Mendeleyev]

[Abstract] A review is presented of the significance of dynamics in chemical processes as a means of ensuring efficiency. The analysis was based on the construction of mathematical models and data derived from experimental studies to assess such processes with respect to time and space. Analysis of non-stationary systems requires consideration of rapid, intermediate, and slow components of the system. The rapid processes assume a quasi-stationary relationship vis-a-vis the intermediate steps, while the slow processes appear to be constant in that same view. In mathematical terms such an approach is based on the theory of singular perturbation equations. Nonlinear interactions in chemical reactions lead to auto-oscillation in the rates of chemical transformations under otherwise constant conditions. Transitional oscillations and even auto-oscillations may arise in systems with two feedback associations with different moments of inertia. The creation of a nonstationary state enhances the intensity of the process and its selectivity. However, transition to a nonstationary state due to the influence of an external factor may have adverse effects as well. The latter may include reduced catalyst lifetime and changes in the hydrodynamic and temperature conditions that are unfavorable to the underlying reaction. In addition, the equipment and instrumentation required may be more complex, and more sophisticated control measures are usually needed. Furthermore, heterogeneity increases in non-stationary processes and the general perturbations pose and additional challenge to the reliability of the apparatus. Figures 7; references 13 (Russian).

12172/13046
CSO: 18410138

STATUS REPORT ON INSTITUTE OF COLLOID CHEMISTRY AND WATER CHEMISTRY IMENI A.V. DUMANSKIY

Kiev VISNYK AKADEMIYI NAUK UKRAYINSKOYI RSR in Ukrainian No 10, Oct 87 pp 3-5

[Text] The Presidium of the UkrSSR Academy of Sciences has reviewed the research and administrative activities of the Institute of Colloid Chemistry and Water Chemistry of the UkrSSR Academy of Sciences for the period 1983-1986.

The report on the institute was delivered by the director A.T. Pilipenko, academician of the UkrSSR Academy of Sciences (UAS); in addition, V.P. Kukhar, UAS academician and secretary of the Department of Chemistry and Chemical Technology of the UAS provided a co-report.

Both reports noted advances in fundamental and applied research for the period in question, and the implementation of research results in various spheres of the national economy.

The principles for a modular approach to water purification have been defined, concentrating on pollutants with various degrees of dispersity. These principles are based on advanced technological innovations, involving flocculation, flotation separation, filtration through grainy materials, membrane filtration, and electrooxidation relying on a suspended layer of a catalyst.

A macrokinetic theory has been developed for slow coagulation, flotation, electrofiltration, reverse osmosis, and charge-selective and bipolar electrodialysis.

Methods have been developed for liquid-phase and photocatalytic destructive oxidation of organic substances, including pesticides. Significant results have been obtained in areas dealing with adsorption theory as it applied to aqueous solutions of organic substances, as well as in studies on the use of microorganisms and enzymes in the treatment of industrial waste waters.

In addition, theoretical foundations have been laid for analyzing the mechanisms of coagulation-thixotropic and condensation-crystallization structure formation in disperse systems (silicate suspensions, oxide-containing compositions, carbon dispersions).

Finally, quantum chemical research has been conducted on the factors responsible for the stability of metal-ligand bonds.

Researchers in the Department of Natural Dispersed Systems have provided a theoretical foundation and gained new experimental insight into selective etherocoagulation [sic] of highly dispersed metals by microorganisms.

Refinements have also been made in methods for preparing multifunctional compositional polymeric electro- and diffusion-phoretic coatings.

The mechanisms responsible for accelerated dispersion of clayey minerals in the presence of highly dispersed siliceous materials have been elucidated.

The fundamental and applied studies at the Institute have also resulted in devising new technology for the production of aluminum hydroxysulfate, a novel coagulant for treating natural and waste waters, as well as in the production of metal-polymer coatings with improved protective characteristics.

Studies on highly dispersed ferromagnetics led to development of novel indicators. Improvements in cement quality have been made possible by introduction of crystallizing components by a hydration method. Semisynthetic sorbents and ion-exchangers have been developed for separation of petroleum products and for water purification.

Highly sensitive spectrophotometric methods have been developed for the analysis of silver, copper, aluminum. and other elements in samples of water, steel, alloys, and other materials.

The scientific program of the Institute included 18 projects of All-Union, Ukrainian SSR, and regional significance, as well as joint programs with organizations and enterprises with USSR ministries, including those responsible for the chemical, fertilizer, coal, gas, and dyestuffs industries.

In that timeframe the researchers published 1250 scientific articles, 30 monographs, and 12 collected works. In addition, 260 declarations were submitted to the State Committee on Inventions, and 190 authors' certificates had been received. The research efforts had been recognized by two UAS Prizes imeni L.V. Pisarzhevskiy, and 47 medals and 20 diplomas from the USSR and UkrSSR Expositions of National Achievement. For successes in socialist competition the Institute has been listed on the UkrSSR Board of Honor.

The Institute itself has undergone reorganization, with the creation of several scientific sections and laboratories, including the Department of Natural Dispersed Systems.

Ties to industry have been strengthened. The cost effectiveness of new technologies and innovations has exceeded forty million rubles. The most significant contributions have been in the development of luminiferous coatings for gas-discharge lightbulbs, preservation of domestic drinking water, recycling water system for the Pervomaysk "Khimprom" Industrial Association, and electrodialysis water purification systems. The Department of Natural Dispersed Systems has developed the technology for production of multilamellar composition coatings, as well as new materials and technology for the production of soft contact lenses with desirable physicochemical and optical characteristics.

A.T. Pilipenko and V.P. Kukhar also noted certain shortcomings in the performance of the Institute. These included the fact that not all complex

research projects led to meaningful end results, end-result oriented research programs are lacking, many research problems are not yet backed-up by adequate scientific substantiation, the productivity of the departments is not at anticipated levels of effectiveness, and too few completed studies receive approval from interdepartmental commissions.

In summarizing the discussion, B.Ye. Paton, president of the UAS, pointed out that the Institute has reorganized its research objectives to some extent. The research that is being done is more goal-oriented and characterized by practical applications. Studies on the treatment and recovery of waste waters have involved leading scientists at the Institute, and have been reinforced with greater material support. The scientists at the Institute have made numerous proposals designed to alleviate the consequences of the accident at the Chernobyl Nuclear Power Station.

Nevertheless, the Institute is faced with problems that must be resolved. The performance of the Institute cannot be regarded as acceptable in view of the emphasis on restructuring by the 27th Party Congress.

The Institute has yet to formulate a policy with regard to technical advancements in the industrial sector for recycling water systems. Studies have been inadequate and recommendations lacking regarding the use of membrane technology and other physicochemical methods for water treatment on an industrial scale.

Increased emphasis has to be placed on training doctoral candidates in high priority disciplines such as analytical chemistry, and to ensure that management will be qualified in conducting scientific investigations in the fields of colloid chemistry, physicochemical methods of water purification, and design of recycling water supply systems. There have been cases in which training has been clearly inadequate.

The administration has failed to implement technological advances, particularly in the case of crystalline components, as well as adsorptive methods and microbiological techniques in water treatment. No analyses are being performed on the competitiveness of the methods developed at the Institute in the market place, nor of the inadequate participation of the Institute in the joint project for technological development of the COMECON countries. There has been no expert analysis of the economic agreements for efficient utilization of the scientific potential of the Institute.

Furthermore, the administration failed to take cost accounting into consideration when analyzing financial support from interested ministries.

On the whole, the UAS Presidium found the activities of the Institute to be satisfactory for the period in question, and approved the recommendations of the general meeting of the Department of Chemistry and Chemical Technology of the UAS regarding the Institute.

The major research orientation for the future should emphasize the following areas: treatment, desalination, and purification of natural and industrial waste waters, as well as mine and mineral waters; design of a closed-loop water supply systems for industrial enterprises, and development of control and automation methods for water treatment; colloid chemistry, surface phe-

nomena, and physicochemical mechanics of dispersions; and chemistry of complex compounds and their utilization in analytical chemistry.

The administration of the Institute has been charged for the 12th Five Year Plan to insure that further developments are made in studies involving the physical chemistry and technology of waste-free water supply based on adsorptive, catalytic, coagulation, flotation, flocculation, and biological methods of water treatment. In addition, emphasis must be placed on the development of membranes and membrane methods of water treatment, the development of colloid chemistry methods for the preparation of new dispersion systems utilizing metallopolymers, ferromagnetics, silicates, and carbon. Finally, new developments are anticipated in materials suitable for electronics, adsorption methods, and catalysts, along with expanded studies on ligand-based complexing agents and their use in environmental monitoring.

The Institute has to improve its training program to meet the demand for highly qualified scientists in leadership positions, and to reinforce scientific studies to meet the needs of the Ukrainian SSR for membrane methods for water treatment.

Finally, the Department of Chemistry and Chemical Technology of the UAS has been instructed to scrutinize the activities of the Institute more closely.

12172
CSO: 18410153

UDC 541.132

THERMODYNAMIC EQUILIBRIUM IN MULTICOMPONENT ELECTROCHEMICAL MATRIX SYSTEM WITH CONCENTRATED CARBONATE ELECTROLYTE

Moscow ELEKTROKHIMIYA in Russian Vol 23, No 9, Sep 87 (manuscript received 5 Feb 85) pp 1193-1202

[Article by V.A. Butenko, B.G. Grishayenkov and T.I. Chernyavina, Institute of Medical-Biological Problems, Moscow]

[Abstract] A comparative analysis was conducted on dilute and concentrated KOH + $KHCO_3$ + K_2CO_3 + H_2O systems for evaluation of the concentration of each component, employing a system of differential equations describing nonstationary nonisothermic heat transfer processes [Butenko, V.A., et al., Elektrokhimiya, 23 (9): 1887, 1987]. Assessment of the system in a state of thermodynamic equilibrium involved determination of the activity coefficients, equilibrium constants, and Henry coefficients at temperatures of 25, 40, and 60°C over a pH range of 10 to 14, with $[K^+]$ = 4 x 10^{-3}, 6 x 10^{-3}, and 8 x 10^{-3} g-ion/cm^3. Significant differences were noted between the equilibrium concentrations of the components for the concentrated and dilute electrochemical systems, with similar differences applicable to the activity and Henry coefficients and the equilibrium constants. Thus, for example, the K_c/K_d ratio (c = concentrated, d = diluted) goes through a minimum as the pH increases from 10 to 14. Furthermore, the value of K_c was significantly below that of K_d (e.g., at pH 14 and 25°C the difference was 8.5-fold). These findings demonstrate that design of carbonate-based systems has to be based on activity coefficients of the components rather than on their concentrations. In addition, the dependence of the equilibrium partial pressure of CO_2 on the pH makes possible identification of pH range for absorption and desorption of CO_2 from the solution. Figures 6; references 13: 9 Russian, 4 Western.

12172/13046
CSO: 18410069

UDC 541.136.3

HYDROGEN ELECTRODE FOR LEAD-HYDROGEN STORAGE BATTERY: ELECTROCHEMICAL BEHAVIOR OF ELECTRODE IN RELATION TO ITS MACROSTRUCTURE

Moscow ELEKTROKHIMIYA in Russian Vol 23, No 9, Sep 87 (manuscript received 25 Aug 86) pp 1252-1255

[Article by O.A. Burmistrov and N.Yu. Lyzlov, All-Union Scientific Research Institute of Storage Battery Design and Construction, Leningrad]

[Abstract] Recent advances in the design of lead-hydrogen storage cells (LHSC) have led to the development of gaseous hydrogen electrodes. The latter differ markedly from hydrogen electrodes used in oxygen-hydrogen fuel elements, electrolyzers, and other types of metal-hydrogen storage cells. Problems that are specific to the hydrogen gas electrodes involve repeated cycles of cathodal and anodal polarization, exposure to the corrosive effects of sulfuric acid, and the capillary characteristics of the PbO_2/separator/H_2-electrode matrix grouping that must ensure adequate saturation of the PbO_2 electrode with the electrolyte and porosity of the hydrogen electrode. Consequently, trials were conducted with hydrogen gas electrodes prepared from two types of activated carbon (AG-3 and SKT-6A) and carbon black obtained by combustion of acetylene. Bonding was provided either by high density polyethylene or f-4D fluoroplastic (5-70 wt%), with the electrodes coated with Pt (0.5-2.5 mg Pt/cm^2). Volt-ampere characteristics of the various electrodes prepared in this manner were determined in 10 N sulfuric acid under 0.98 kPa hydrogen. Analysis of the I vs. E plots depicting electrochemical activity, indicating that current generation was due to an internal diffusion mechanism in all cases. With low concentrations of the water repellants, hysteresis was observed only on the anodal part of the polarization curve. Satisfactory results were obtained in tests using the most promising electrodes in lead-hydrogen storage cells. The current loads on the hydrogen electrodes evoked polarization that was equivalent to that on the lead dioxide electrode. Figures 3; references 2 (Russian).

12172/13046
CSO: 18410069

UDC 541.138.3

CATHODAL REDUCTION OF SULFUR DIOXIDE FROM NONAQUEOUS ELECTROLYTES ON POROUS ELECTRODES BEARING PHTHALOCYANINE

Moscow ELEKTROKHIMIYA in Russian Vol 23, No 9, Sep 87 (manuscript received 22 Dec 86) pp 1262-1263

[Article by Ye.M. Shembel, O.S. Ksenzhek, N.P. Danilova and V.A. Shustov, Dnepropetrovsk Institute of Chemical Technology imeni F.E. Dzerzhinskiy]

[Abstract] In order to improve the high energy chemical sources of current represented by the Li-SO_2 system, a study was conducted on the effects of

incorporation of Fe-phthalocyanine into the electrode on cathodal reduction of SO_2 from nonaqueous solvents. The electrodes were prepared from activated carbon R-33 with precipitation of Fe-phthalocyanine from concentrated sulfuric acid, using SR-1 fluoroplastic as binding agent. The catalytic electrodes contained 20 wt% Fe-phthalocyanine. The electrochemical studies with noncatalytic and catalytic electrodes were conducted under dry argon with 12 wt% SO_2 solution of lithium perchlorate in propylene carbonate. The galvanostatic plots demonstrated that incorporation of the catalyst led to a significantly higher discharge potential for the cathodal reduction of SO_2, that may be due to reduction of phthalocyanine. In addition, the decrease in the discharge time of the electrodes with phthalocyanine may have been due to altered pore-size distribution curve. Additional experiments showed that treatment of catalyst-bearing electrodes with sulfur vapors at 150°C led to doping of the electrode surface with sulfur, leading to a decrease in the discharge potential. These findings point to the utility of studies using highly catalytic agents for increasing the discharge potential of Li-SO_2 current generators. (Electrodes containing iron phthalocyanine were prepared in the Department of Electrochemistry and Corrosion of the Technology University, Dresden.) Figures 1; references 6: 3 Russian, 3 Western.

12172/13046
CSO: 18410069

UDC 544.135.4

HIGH-TEMPERATURE SOLID ELECTROLYTE OXYGEN PUMP: SPECIFIC ENERGY CONSUMPTION

Moscow ELEKTROKHIMIYA in Russian Vol 23, No 9, Sep 87 (manuscript received 5 Feb 85) pp 1263-1266

[Article by G.N. Voloshchenko, N.V. Korovin and Yu.A. Slavnov, Moscow Energetics Institute]

[Abstract] A mathematical analysis was conducted on the efficiency of a solid electrolyte oxygen pump in relation to current flux per unit of oxygen volume produced. Analysis of data obtained for a ZrO_2 system demonstrated that there were no meaningful differences in the specific power consumption per unit of oxygen for cells connected in parallel or in series. An equation was derived for assessment of energy consumption relying on data on the current flux, molar fraction of oxygen in air, electrical resistance of the electrochemical cells, and the utilization factor for oxygen from air. Figures 3; references 4: 2 Russian, 2 Western.

12172/13046
CSO: 18410069

UDC 541.134.5

THERMODYNAMIC PROPERTIES OF ELECTROCHEMICAL COUPLE Li/$LiClO_4$ (PROPYLENE CARBONATE)/Li_xMnO_2

Moscow ELEKTROKHIMIYA in Russian Vol 23, No 11, Nov 87 (manuscript received 6 Feb 86) pp 1459-1464

[Article by B.A. Ravdel, M.Yu. Pozin, K.I. Tikhonov and A.L. Rotinyan, Leningrad Technologic Institute imeri Lensovet]

[Abstract] The goal of this study was to determine thermodynamic functions of partially-reduced oxide-manganese electrodes in lithium perchlorate solution in propylene carbonate (PC) as well as to determine the overall electrode reaction. Equilibrium potential of the couple and its temperature coefficient were determined at 0.01 x 0.99. An assumption was made about existence of a solid solution of a compound with shifting stoichiometry $Li_nMnO_2[n=n(x)]$ in MnO_2. Thermodynamic functions of this system were analyzed in light of the available experimental and literature data. Figures 4; references 17: 6 Russian, 11 Western (1 by Russian author).

7813/13046
CSO: 18410171

UDC 541.135.5

ELECTROCHEMICAL OXYGEN REGENERATION SYSTEM WITH BINARY ELECTROLYTE

Moscow ELEKTROKHIMIYA in Russian Vol 23, No 11, Nov 87 (manuscript received 5 Feb 85) pp 1489-1497

[Article by V.A. Butenko, B.G. Grishayenkov, A.M. Arkharov, A.V. Vitkovskiy and V.B. Sayenko, Moscow Higher Technical School imeni N.E. Bauman; Institute of Medical Biological Problems, Moscow]

[Abstract] Earlier papers dealt with mathematical description of nonstationary nonisothermal processes of heat transfer in an electrochemical matrix system of atmospheric regeneration. In the present work, heat transfer processes are analyzed in an electrochemical O_2 regeneration system consisting of porous electrodes separated by a porous diaphragm. Using the same nonstationary, nonisothermal model, without consideration of the effect of concentration and temperature, it was shown that the electrolyte concentration on both sides of the diaphragm changes uniformly in time (analogously to the isothermal model). Maximum value of the gradient of electrolyte concentration is reached in the stationary state. When concentration and temperature are considered, the concentration changes from both sides have an extremal character, the maximum concentration gradient being achieved in a nonstationary regimen. This could lead to problems: on the cathode side of the diaphragm the electrolyte concentration could exceed the maximum level and the electrolyte could start precipitating, while the opposite could occur on the anode side, leading to maximum current levels. Creation of an artificial

circulation between these two sides by a temperature gradient results either in a complete or partial decrease of the concentration gradient in the diaphragm. Figures 6; references 6 (Russian).

7813/13046
CSO: 18410171

UDC 541.138;541.135.5

MODIFICATION OF PLATINUM OXIDE ELECTRODE WITH NAPHTHOQUINONE CAPABLE OF FUNCTIONING IN BACTERIAL PHOTOSYNTHETIC REACTION CENTERS

Moscow ZHURNAL FIZICHESKOY KHIMII in Russian Vol 61, No 11, Nov 87 (manuscript received 15 Jul 86) pp 3009-3015

[Article by Ye.Yu. Kats, A.Ya. Shkuropatov, O.I. Vagabova and V.A. Shuvalov, Institute of Soil Science and Photosynthesis, USSR Academy of Sciences, Pushchino]

[Abstract] Photoinduced separation of charges in photosynthetic reaction centers (RC) could lead to production of photocurrent and a photopotential in electrochemical systems, albeit with low efficiency. To increase this efficiency, electron transfer mediators must be used. The electron acceptors in RC of the photosynthesizing bacteria are quinones which could be replaced by synthetic compounds without any loss of activity. In this paper chemical modification of platinum oxide electrodes with naphthoquinone is described which continued functioning in a system of bacterial photosynthesis RC, replacing the original ubiquinone. Electrochemical properties of modified electrode are investigated. It is shown that this quinone immobilized in a monolayer underwent quasi-reversible reduction during hundreds of electron transfer cycles. The limiting factor in this was a low transfer rate constant for the electrochemical process which made its utilization ineffective. Figures 6; references 16: 4 Russian, 12 Western.

7813/13046
CSO: 18410171

UDC 621.318.134

$BaO-TiO_2-SiO_2$ SYSTEM WITH VARIOUS COMPONENT RATIOS

Kiev UKRAINSKIY KHIMICHESKIY ZHURNAL in Russian Vol 53, No 9, Sep 87 (manuscript received 17 Mar 86) pp 910-912

[Article by A.G. Belous, Z.Ya. Makarova, O.A. Shakharov, V.P. Chalyy and Yu.I. Gornikov, Institute of General and Inorganic Chemistry, Ukrainian SSR Academy of Sciences, Kiev]

[Abstract] In view of the controversy that applies to the putative existence of $BaTiSiO_5$ (I) and the data suggesting that, in fact, the product is actually $Ba_2TiSi_2O_8$ (II), represented in nature by the mineral fresnoite, a study was conducted on phase transitions occurring in $BaCO_3-TiO_2-SiO_2$ mixtures. Corresponding component ratios of 2:1:2 and 1:1:1 were employed with heat treatment in the 800-1300°C range. The resultant products were subjected to thermogravimetric, x-ray, and IR analyses, with the results providing further confirmation that II was formed, characterized by a tetragonal unit with a = 8.52 Å and c = 5.21 Å. Solubility of excess TiO_2 in II was attributed to defects in the latter, with a solubility limit of ca. 4 moles. Figures 1; references 8: 2 Russian, 5 Western.

12172/13046
CSO: 18410073

UDC 537.311.33

ENTHALPY OF DEFECT FORMATION IN MERCURY CHALCOGENIDE CRYSTALS ALLOYED WITH THALLIUM

Baku AZERBAYDZHANSKIY KHIMICHESKIY ZHURNAL in Russian No 6, Nov-Dec 86 pp 101-103

[Article by M.M. Asadov, S.N. Mustafayeva and A.A. Movsumzade, SKTB KPMS s OP pri INFKh [expansion unknown], Azerbaijan SSR Academy of Sciences]

[Abstract] The physical properties of mercury chalcogenides have shown them to be promising materials for use in solid state electronics, opto- and acoustic electronics, as well as in piezo and laser technologies. However, in view of the paucity of data on the thermodynamics of point defects in the

mercury chalcogenide crystals, the enthalpy values were determined for thallium-doped (0.1 at%) samples at thermal equilibrium. The slopes of $\log\Delta\rho$ vs. $10^3/T$ plots yielded respective ΔH values of 4.0, 3.0, 2.3, and 1.2 eV for α-HgS, β-HgS, HgSe, and HgTe doped with thallium. Analysis of resistivity vs. temperature plots over a temperature range of 275 to 1075 K showed an increase in mercury vacancies. In the case of HgTe the increase was approximately ten orders of magnitude. Figures 1; references 6: 4 Russian, 2 Western.

12172/13046
CSO: 18410073

UDC 678.026

POLYMERIZATION OF ADAMANTANE VAPORS IN COMBINED ELECTRIC DISCHARGE

Moscow ZHURNAL FIZICHESKOY KHIMII in Russian Vol 61, No 11, Nov 87 (manuscript received 17 Sep 86) pp 3070-3073

[Article by D.V. Fedoseyev, I.G. Varshavskaya, V.P. Varnin, Ye.I. Bagriy and A.V. Lavrentyev, Institute of Physical Chemistry, Institute of Petrochemical Synthesis imeni A.V. Topchiyev, USSR Academy of Sciences, Moscow]

[Abstract] Precipitation of solid film from gaseous adamantane in combined electric discharge (glowing and high frequency) is studied. Adamantane is a fragment of the crystalline lattice of diamond and it could be expected that during the polymerization process adequately lengthy objects could be generated with diamond structure. The experiments were carried out in a quartz reactor 2.5 cm in diameter; a diagram of this setup is presented. The films obtained were very strained and did not adhere to molten quartz. The IR spectra of thus-obtained adamantane film showed absorption bands in the range 1280 and 2810 cm^{-1}, these bands not being present in the parent material; also bands in the region of -Ch and $-CH_2$ were present. An assumption is expressed that adamantane polymerization begins in the gaseous phase, forming fragments with diamond structure. This highly-dispersive aerosol is precipitated on a support as a result of the high-frequency field. In parallel, the non-crystalline polymer is precipitated, trapping diamond microparticles in its structure. Figures 3; references 6: 4 Russian, 2 Western.

7813/13046
CSO: 18410172

UDC 541.128:135:541.454:542.938:547.26'118

ALKALINE HYDROLYSIS OF ETAFOS IN MICELLAR ORGANOPHOSPHORUS SURFACTANT SOLUTIONS

Moscow IZVESTIYA AKADEMII NAUK SSSR: SERIYA KHIMICHESKAYA in Russian No 10, Oct 87 (manuscript received 18 Mar 86) pp 2161-2166

[Article by L.Ya. Zakharova, S.B. Fedorov, L.A. Kudryavtseva, A.M. Zotova, V.Ye. Belskiy and B.Ye. Ivanov, Institute of Organic Chemistry and Physical Chemistry imeni A.Ye. Arbuzov, Kazan Branch, USSR Academy of Sciences]

[Abstract] The rate of nucleophilic substitution in esters of tetracoordianted phosphorus acids has been shown to be affected by ionogenic surfact micelles: cationic surfactants have been demonstrated to accelerate nucleophilic substitution, and, anionic, to retard them. In both cases the micellar effect depends on the extent of binding of the substrate to the micelle. Similar parameters were evaluated for the alkaline hydrolysis of etafos (O-ethyl-S-propyl-O-(2,4-dichlorophenyl)-thiophosphate) in relation to the structure of the anionic organophosphorus surfactant micelles. The studies were conducted with disodium salts of monophosphoric acid and sodium salts of monododecylphosphonic acids, introduction of which into basic solutions led to a sharp decrease in the rate of hydrolysis of etafos. The inhibitory effects were directly related to the concentration of the surfactant and are structure-dependent. The decrease in the rate constants was on the order of 40- to 60-fold, but less than seen with sodium dodecylsulfate. The mechanism for this effect involved transition of the insecticide (etafos) into the micellar milieu. Electrostatic repulsion of nucleophilic OH^- ions from the micellar surface by its negative charge resulted in diminished rate of hydrolysis. Figures 3; references 12: 7 Russian, 5 Western.

12172/13046
CSO: 18410155

UDC 632.982.2

ELECTRICALLY CHARGED PESTICIDE AEROSOLS

Moscow ZASHCHITA RASTENIY in Russian No 9, Sep 87 pp 59-61

[Article by I.A. Turchin, candidate of technical sciences]

[Abstract] Conventional pesticide aerosols are currently being replaced by electrically charged aerosols, offering greater economy and less danger of environmental pollution. It has been estimated that 50-70 percent of applied pesticides are lost due to wind factors and runoff from plants. Charged particles offer the advantage of electrostatic adherence to plant surface, requiring a much thinner layer on the plants and providing much greater cost effectiveness. Furthermore, significantly less aerosol is lost to wind factors. Currently, two methods are used for generating charged aerosols: electrostatic and electrodynamic. The former method is especially suitable for working with aqueous suspensions and emulsions, and the latter method with oily preparations. Although charged pesticide aerosols have found extensive application in the West, in the USSR studies on such aerosols and their practical application in agriculture have lagged behind.

12172/13046
CSO: 18410158

PROBLEMS ATTENDANT TO IMPLEMENTATION OF PETROCHEMICAL INTRAPLANT COST ACCOUNTING WITHIN SELF-FINANCING FRAMEWORK

Moscow KHIMIYA I TEKHNOLOGIYA TOPLIV I MASEL in Russian No 9, Sep 87 pp 2-6

[Article by G.V. Zhuk, chairman, Financial Administration, USSR Ministry of Petrochemical Industry]

[Abstract] With implementation of self-financing in the oil refining and petrochemical industries, an entirely new approach has to be taken to analysis of cost factors at the level of individual shops and units within a given plant or complex. To that end, new regulations have been formulated to encourage initiative by workers and enhance labor productivity. Basically, the entire process may be reduced to implementation of cost accounting at various organizational levels within a plant that deal with production and quality control. A completely new information system has to be introduced to keep the team of workers apprised of market demands and of otherwise encouraging their participation in the decision-making process. Following the setting of definitive production plans, the workers should be informed of the new plans five to ten days before they are implemented, with the econometric parameters on which such decisions are based carefully explained. A new reorientation and attitude must be instilled in the workers and practiced by the managements to make the concept of cost-effectiveness a reality in the Soviet industry.

12172/13046
CSO: 18410075

UDC 665.73/753

INSTALLATION FOR PRODUCTION OF ENGINE FUELS FROM GAS CONDENSATE OF URENGOY DEPOSITS

Moscow KHIMIYA I TEKHNOLOGIYA TOPLIV I MASEL in Russian No 9, Sep 87 pp 6-7

[Article by I.M. Ponomareva, "Lenneftekhim" Scientific Production ASsociation]

[Abstract] A schematic is provided for an installation designed to process gas condensate obtained from Urengoy fields into various types of engine fuels. The design of the installation was based on market needs and the quality of the condensate. The products obtained consisted of gasoline with an octane number of 63-64 (31.50 percent), jet fuel TS-1 (16.25 percent), wide fraction diesel fuel (43.00 percent), boiler fuel (8.75 percent), with only a 0.50 percent lost as waste products. The installation was designed to operate under severe climatic conditions to provide motor fuels for the Far North and Siberia. Figures 1.

12172/13046
CSO: 18410075

UDC 662.741.3.004.14

MANAGEMENT OF LABORATORY-BASED QUALITY CONTROL IN COAL-TAR-CHEMICAL INDUSTRY

Moscow KOKS I KHIMIYA in Russian No 9, Sep 87 pp 47-52

[Article by V.M. Chuishchev and Z.G. Selivanova, Avdeyevskiy Coal-Tar-Chemical Plant]

[Abstract] An analysis was conducted on the operation of quality control laboratories at coal-tar-chemical plants, to better evaluate the manner in which they should be organized and managed. The functions of such laboratories go beyond monitoring the quality of the chemicals being produced, encompassing as they do in-process evaluation and evaluation of reagents and raw materials used in the industry. Tabulated results are provided that depict the different kinds of laboratory analyses on a 24 h scale. The results clearly show that, to meet the productivity and economic goals of a plant, account must be taken of the timeliness and accuracy of the results that are being provided. Basing an evaluation of the laboratory service simply on the availability of qualified personnel, equipments and supplies, facilities, and quantitative data on tests that have been run is not enough if the accuracy and timeliness are neglected. Figures 1; references 4 (Russian).

12172/13046
CSO: 18410075

UDC 662.741.3.022:620.113

ERRORS OF SAMPLING IN COAL INSPECTION

Moscow KOKS I KHIMIYA in Russian No 9, Sep 87 pp 53-54

[Article by K.R. Ditman, L.M. Kharkina, candidate of technical sciences, S.S. Toryanik, A.I. Virozub, candidate of physicomathematical sciences, and M.V. Lurye, candidate of technical sciences, UKhIN [expansion unknown]

[Abstract] The need for a better approach to sampling coal is underscored by the experience in the 11th Five-Year Plan in which the enterprises of the UkrSSR Ministry of Coal Industry delivered almost 90 million tons of sub-standard coal. This figure represented almost 9.9% of the total coal that was delivered, and was due largely to out-of-date state standards that tolerate excessive ash and moisture levels because of unrealistically-high tolerance limits. The base error method for assessing sample errors was tried on 4,250 samples tested for ash and 2,870 for moisture, demonstrating that the allowable base errors were two-fold lower than those tolerated by state standards. Calculation of the base error (T, %) was based on the following equation: $T = t(2.5\%;n)\sqrt{S^2(\Delta)/2}$, where $t(2.5\%;n)$ is the 2.5% Student's distribution point with n pair of duplicate samples, and $S^2(\Delta)$ is the dispersion of differences between duplicate samples. Figures 1.

12172/13046
CSO: 18410075

UDC 666.63/663

EVALUATION OF EGYPTIAN CRUDE OIL FROM RAS GHARIB FIELDS

Baku AZERBAYDZHANSKIY KHIMICHESKIY ZHURNAL in Russian No 6, Nov-Dec 86 pp 67-70

[Article by I. Basili, M.M. Mirdzhavadova, Dzh.I. Allakhverdiyev, M.I. Rustamov and V.S. Aliyev, Institute of Petrochemical Processes imeni Yu.G. Mamedaliyev, Azerbaijan SSR Academy of Sciences]

[Abstract] Crude oil obtained from the Ras Gharib fields in Egypt in 1984 was analyzed for commercial applications. The samples tested had a density of 928.9 kg/m^3 at 20°C, a viscosity of 35.2 mm/sec at 30°C, a pour point of 2°C, and a flash point of 23°C. The coke capacity of the oil was 10.9%, ash content 0.07%, and acid number 1.0 mg KOH/g. Chemical analysis revealed the presence of 8.06% paraffins (56°C mp), 21% silicagel resins, and 11.7% asphaltenes. The heavy, high-paraffin, high-resin, and high-sulfur oil was subjected to hydrofining. Analysis of the gasoline fractions (5.50% at 120°C and 14.05% at 200°C) showed that paraffins accounted for 28-30 wt%, indicating a low octane number. On that basis, the hydrorefined gasoline fractions appear best suited for use as components of automobile gasolines. References 3: 2 Russian, 1 Western (Russian translation).

12172/13046
CSO: 18410075

UDC 678.742:546.268.2

MODIFICATION OF POLYOLEFINS BY ISOCYANATES

Moscow PLASTICHESKIYE MASSY in Russian No 9, Sep 87 pp 18-20

[Article by V.P. Arkhireyev, A.V. Kochnev and F.T. Shageyeva]

[Abstract] A cursory review is presented of the effects of modification of polyolefins by aliphatic and aromatic isocyanates, as well as by adducts formed by the reaction of isocyanates with industrial stabilizers. The derived products obtained by modification of low and high density polyethylenes, atactic and stereospecific propylenes, and ethylene:propylene (2.1% propylene) copolymers demonstrated that this form of chemical modification imparted marked physicochemical changes that expanded the commercial applications of these polymers. In general, introduction of the isocyanate groups into the polymer in question not only prolonged the latent period for thermooxidation, but also decreased the rate of reaction with oxygen. The melting and flow points of the products were usually reduced by 10-40 K. Plots of the tangent of the dielectric loss angle for the modified polymers vs. temperature showed a shift in beta-transition toward negative temperatures by 40-65 K in comparison with the unmodified polymers. Isocyanate modifications also led to a decrease in viscosity due to more extensive branching of the polyolefins, as reflected in actual measurements and in an increase in the energies of activation of viscous flow from ca. 47.9 to 50 kJ/mole in the case of polypropylene. Finally, the adhesive characteristics of the polymers were also enhanced. In the case of adhesion to metal surfaces the improvement amounted to one or two orders of magnitude and was attributable to the introduction of electron donor groups, such as -N=C=O and -NHCO. The latter groups favored formation of hydrogen and coordination bonds with metal oxides and hydroxides, with ion-dipole interactions also postulated to play a meaningful role. Figures 2; references 4 (Russian).

12172/13046
CSO: 18410076

UDC 678.74.01:536.5

POLYOLEFIN POLYMERIC MATERIALS STABLE AT CRYOGENIC TEMPERATURES

Moscow PLASTICHESKIYE MASSY in Russian No 9, Sep 87 pp 37-39

[Article by N.N. Severova, V.V. Drozdov, V.A. Muratkhanov, Ye.V. Veselovskaya, G.M. Rafaylovich, A.M. Ovis and V.A. Grigoryev]

[Abstract] Extended preservation of blood and other biological products by cryogenic methods has made the packaging material of prime concern. Such materials must be inert vis-a-vis the bioproducts and tolerant of sharp temperature drops (e.g., from room temperature to 77 K), and withstand storage at temperatures ranging from that of liquid nitrogen (77 K) to 320 K. Furthermore, in addition to withstanding freezing and thawing cycles, such materials must also remain unaffected by low levels of ionizing radiation often used for sterilization of biological products. To that end, studies were conducted with polyolefins to determine the effects of low temperatures on the mechanical and physical properties of films prepared from such polymers. The samples under study consisted of low-density polyethylene and copolymers of ethylene with propylene and with butene-1. The resultant data on the MW, density, crystallinity, plastic and elastic deformations, etc., are summarized in tabular form for the different samples. The key factor determining serviceability, however, was determined to be the elongation at rupture, which ranged from 980-1080% at 323 K to 1.5-6% at 40 K. On balance, greatest tolerance of low temperatures and suitability for work, at 77 K and lower temperatures, was demonstrated by the ethylene:butene copolymer containing 0.5-1.5 mole% butene-1. Figures 1; references 9: 7 Russian, 2 Western.

12172/13046
CSO: 18410076

STATE INSPECTION AND QUALITY CONTROL

Moscow KAUCHUK I REZINA in Russian No 9, Sep 87 pp 2-5

[Article by L.V. Pasternak]

[Abstract] The decisions and resolutions of the 27th Party Congress, emphasizing, as they do, quality in Soviet industry, have found a willing response in the tire industry. An additional 48 enterprises in the petrochemical and oil refinery sector have come under state inspection as of January 1, 1987, meaning that quality control is now under the jurisdiction of the State Standards Committee. The significance of new standards and quality control measures in the tire industry cannot be underestimated for, as explained by N.I. Ryzhkov, chairman of the USSR Council of Ministers, an increase in the useful lifetime of tires by merely 10 percent would eliminate tire shortage in the USSR. However, it must be understood that improvements in tire quality are not the responsibility solely of the manufacturers per se,

but involve the entire complex structure of the Soviet industry. Strenuous administrative, technological, scientific, and psychological prerequisites have to be met to ensure a smooth productive process on which product quality depends. Shortcomings in any aspect of the process must be identified in a timely manner and corrected without delay, with the experience gained used for future improvements and economic growth.

12172/13046
CSO: 18410076

UDC 678.07:538.221

EFFECTS OF LIQUID RUBBER ON PROCESSABILITY, PHYSICOMECHANICAL AND MAGNETIC PROPERTIES OF MAGNETOELASTOMERS

Moscow KAUCHUK I REZINA in Russian No 9, Sep 87 pp 40-41

[Article by N.Ya. Ovsyannikov, A.Ye. Kornev, A.A. Delektorskiy and A.G. Alekseyev]

[Abstract] Rubbers with excellent magnetic properties that are imparted by various fillers suffer from the disadvantage that processing is rendered difficult in view of deterioration of various other desirable characteristics. An approach was taken to improve the processability, physicomechanical and magnetic properties of magnetoelastomers by the incorporation of liquid rubber. Specific studies dealt with replacement of up to 50 wt% of the high MW component of natural rubber, synthetic butadiene nitrile rubber (SKN-40), and of chloroprene rubber (SR-50) with liquid rubber (oligobutadiene Buna 32, PDI-0, FP-65, SKD-KTR). Barium ferrite was added to impart magnetic properties (500-900 wt no per 1000 wt no polymer). The resultant analysis of the products showed considerably improved processability and retention of magnetic characteristics despite the elimination of conventional plasticizers. Best results were obtained with the use of SKD-KTR liquid rubber. Figures 1; references 3 (Russian).

12172/13046
CSO: 18410076

UDC 542.952.6

EFFECTS OF UV LASER ON SURFACE PHOTOPOLYMERIZATION OF METHYL METHACRYLATE

Moscow ZHURNAL FIZICHESKOY KHIMII in Russian Vol 61, No 9, Sep 87 (manuscript received 17 Oct 86) pp 2523-2524

[Article by A.V. Shaposhnik, G.A. Grigoryeva and V.K. Potapov, Scientific Research Physicochemical Institute imeni L.Ya. Karpov, Moscow]

[Abstract] Studies were conducted on the course of polymerization of methyl methacrylate on an aluminum surface as a result of exposure to pulses of YAG-Nd laser (266 nm). A piezoquartz microgravimetric method with a sensitivity of ca. 1 ng/cm^2 was employed to monitor polymerization of the monomer vapors in relation to vapor pressure and intensity of irradiation. Plots of the rate of polymer growth vs. monomer vapor pressure indicated that reactions occurring in the adsorbed layer were responsible for polymerization, whereas contribution of the gas phase was, at best, very minor. Analysis of plots of the rate of polymerization vs. intensity showed that the linear plots were compatible with a mechanism involving recombination of radicals with formation of neutral molecules. The latter are reabsorbed and undergo retransformation into radicals. Chain reactions appear to play a minor role, due largely to the high energy of the laser pulses and the formation of large concentrations of radicals. A more detailed understanding of the role of active particles in these processes would require an ESR study. Figures 2; references 5: 3 Russian, 2 Western.

12172/13046
CSO: 18410077

UDC 621.373.826:539.2

RESONANCE EFFECTS OF IR LASER ON POLYMERS

Moscow KHIMIYA VYSOKIKH ENERGIY in Russian Vol 21, No 5, Sep-Oct 87 (manuscript received 15 May 86) pp 473-477

[Article by Yu.A. Bykovskiy, A.S. Sokolnikov, V.A. Ukraintsev and A.A. Chistyakov, Moscow Institute of Engineering Physics]

[Abstract] An analysis was conducted on the resonant energy-mediated degradation of polymers by IR laser emissions, using excitation of a $LiIO_3$ crystal (2.5-3.2 mcm, ca. 30 nsec pulses, 0.2 J/pulse). The studies were conducted with linear, nonbranching cellulose nitrate films, 0.1 cm thick. The samples were studied in vacuo (1.33 x 10^{-4} Pa) and subjected to 10^7-10^9 W/cm^2 IR laser energy beam focused to a 0.8-3.0 mm spot. Mass spectroscopy of the products obtained by exposure of the polymer to resonance effects on the valency oscillations of the OH group yielded peaks at 18, 28, 29, 30, 44 and 46 m/e, corresponding to H_2O, CH_2O, CO, CO_2, NO, and NO_2. Analysis of

the relative yields of the gaseous products showed that the resonance effects were accompanied by anomalously high yields of formaldehyde. At $q = 5 \times 10^7$ W/cm^2, CH_2O represented 37% of the yield, and at $q = 2 \times 10^8$ W/cm^2, the figure had risen to 59%. Furthermore, with an increase in q, the fraction of N compounds decreased. The selective production of CH_2O from cellulose nitrate was due to the fact that the resonance of the laser beam corresponded to the absorption band of the valency oscillation of the OH groups. The non-equilibrium degradation of the polymer was attributed to slow relaxation of the oscillation energy along the unbranched chains of the polymer. Figures 2; references 15: 13 Russian, 2 Western.

12172/13046
CSO: 18410077

UDC 541.15

REACTIVITY OF FREE INORGANIC RADICALS WITH PLUTONIUM(III) IN AQUEOUS SOLUTIONS

Moscow KHIMIYA VYSOKIKH ENERGIY in Russian Vol 21, No 5, Sep-Oct 87 (manuscript received 20 Mar 86) pp 478-479

[Article by A.V. Gogolev, A.M. Fedoseyev and A.K. Pikayev, Institute of Physical Chemistry, USSR Academy of Sciences]

[Abstract] Pulse radiolysis was employed in studying the reactivity of $HSO_4^{\cdot}$, $NO_3^{\cdot}$, Cl_2^{-}, and Br_2^{-} with Pu(III) in concentrated aqueous solutions. Irradiation was conducted in a linear U-12 accelerator yielding 5 MeV electrons in 2.3 msec pulses with pulse energies of 8-32 Gy. Plots of rate constant vs. acid concentration provided data demonstrating that the inorganic radicals ranked as follows in terms of reactivity with Pu(III): $HSO_4^{\cdot} > NO_3^{\cdot} > Cl_2^{-} > Br_2^{-}$. The actual rate constants were on the order of 10^6 to 10^8 dm^3/mole·sec). Figures 1; references 6: 4 Russian, 2 Western.

12172/13046
CSO: 18410078

UDC 539.163

DETERMINATION OF DECAY HALF-LIFES OF Es-253, Es-254, Es-254m, Es-255, ES-257 AND Fm-256

Leningrad RADIOKHIMIYA in Russian Vol 29, No 4, Jul-Aug 87 (manuscript received 29 Jul 85) pp 447-500

[Article by Yu.S. Popov, G.A. Timofeyev, V.B. Mishenev, V.N. Kovantsev and A.A. Yelesin]

[Abstract] Semiconductor alpha-, gamma-, and -ray spectrometries were employed in identifying Es and Fm isotopes in Cf targets irradiated in a nuclear reactor. The Cf-252 targets were irradiated in a high flux SM-2 reactor to 10^{21} neutr/cm^2 fluence, then dissolved in nitric acid for separation of Cf, Es, and Fm by elution chromatography in sulfocationite-ammonium-alpha-hydroxybutyrate system. Analysis of the decay plots for the Es and Fm radioisotopes led to the following half-lifes: Es-253 -- 20.50 days, Es-254 -- 266 days, Es-254m -- 1.66 days, Es-255 -- 38 days, Ex-257 -- 7.7 days, and

Fm-256 -- 2.5 days. These results were in very good agreement with the data previously published by other researchers. Figures 3; references 24: 5 Russian, 19 Western.

12172/13046
CSO: 18410078

UDC 546.799.5

ELECTROCHEMICAL OXIDATION OF AMERICIUM IN PYROPHOSPHATE SOLUTIONS

Leningrad RADIOKHIMIYA in Russian Vol 29, No 4, Jul-Aug 87 (manuscript received 11 Jun 86) pp 494-500

[Article by Yu.M. Kulyako, T.I. Trofimov, I.A. Lebedev and B.F. Myasoyedov]

[Abstract] Studies were conducted on electrochemical oxidation of Am(III) in $Na_4P_2O_7 \cdot 10H_2O$ $(NH_4)_4P_2O_7$. The measurements were made over a pH range of 0.5 to 10, using 1-2 mM Am(III) concentrations, and an anode potential of +1.5 to +1.9 V for oxidation and +0.8 to +1.25 V for reduction of the oxidized forms. Concentrations of the various oxidation states of Am in the course of electrolysis were measured spectrophotometrically from absorption bands at 400 to 1100 nm. At a potential of 1.9 V Am(III) was completely oxidized to Am(IV) in 0.1-1 M pyrophosphate ion solutions at pH $\leq$1. In solutions with alkaline pH Am(III) underwent complete oxidation to Am(VI), and reduction of Am(VI) led to Am(V). The higher oxidation states of Am were sufficiently stable to suggest their use in analytical procedures. Measurements of the oxidation potentials of the Am(IV)/Am(III) pair yielded a value of +1.24 V in 1 M $(NH_4)_4P_2O_7$ at pH 6, while the oxidation potential of the Am(VI/Am(V) pair in 0.1 M $Na_4P_2O_7$ at pH 7 was +1.06. Figures 3; references 22: 16 Russian, 6 Western.

12172/13046
CSO: 18410078

UDC 52-74:66.06

DEVELOPMENT OF MATHEMATICAL MODEL FOR URANIUM OXIDE SOLUBILITY. PART 1. DEVELOPMENT OF MATHEMATICAL MODEL FOR SOLUBILITY OF PULVERIZED URANIUM DIOXIDE IN NITRIC ACID

Leningrad RADIOKHIMIYA in Russian Vol 29, No 4, Jul-Aug 87 (manuscript received 10 Jul 86; in final form 3 Mar 87) pp 500-505

[Article by Yu.M. Zhukovskiy, O.P. Luksha, E.A. Nenarokomov, A.A. Pogorelyy and A.V. Pronin]

[Abstract] Solubilization of pulverized uranium dioxide in nitric acid is an important step in processing ceramic nuclear fuel in reactor thermal and fast neutrons, with mathematical modeling representing a step toward greater efficiency and automation of the entire process. A statistical model has been advanced for describing the process in which pulverized uranium dioxide is solubilized in nitric acid, which demonstrated the utility of the simplex method for evaluating the various parameters. The experimental data were derived for studies using granules reaching 1.5 mm in size, 6-12 M nitric acid, and temperatures ranging from 60°C to the BP. The kinetic solubility plots were evaluated with respect to grain size, temperature, and acid concentration, with the independent experiments yielding a mean-square error of ca. 5%. Tabulated data for the rate constants of solubilization demonstrated that this parameter increased with temperature, and nitric acid concentration, and decreased with an increase in the mean grain size of the uranium dioxide powder. Figures 2; references 17: 10 Russian, 7 Western.

12172/13046
CSO: 18410078

UDC 539.219.3:621.039.8

EXPERIMENTAL METHOD FOR STUDYING DIFFUSION OF RADIOACTIVE GASES IN SOLID BODIES. PART 11. EXPERIMENTAL APPARATUS AND METHODS FOR RADIOACTIVE TRACERS

Leningrad RADIOKHIMIYA in Russian Vol 29, No 4, Jul-Aug 87 (manuscript received 28 Dec 85) pp 542-549

[Article by I.N. Bekman]

[Abstract] Description is provided of experimental methodology for studying diffusion of radioactive gases in solid bodies. The design of the apparatus allowed several approaches for introducing radioactive gas tracers into solids, including ionic bombardment, silent discharge, or diffusion of the gas in special cells in vacuo or at elevated pressures and temperatures from 25 to +700°C. Subsequent gas release from the solid was induced by heating of the radioactive noble gases and spectroscopic analysis, i.e., the so-called thermostimulated gas release or thermodesorption spectroscopy. Cursory

details are provided for an apparatus using $RaCl_2$ adsorbed on zeolite in evacuated ampules (ca. 0.1 Pa). Subsequent evacuation under pressure and a high-frequency discharge led to ionization of the radon and acceleration of the ions. The 10-14 keV ions were incorporated to a depth of 1-2 nm in the solid target. The method and similar approaches were also tried successfully with other noble gases (primarily Kr-85, Xe-133, and Rn-222). Targets from which the tracer gases were regularly released and studied included thorium, quartz glass, titanium hydroxide, and low-density polyethylene.

12172/13046
CSO: 18410078

UDC 546.110.23

TRITIUM IN INTERNATIONAL WATERS: 1981-1984

Leningrad RADIOKHIMIYA in Russian Vol 29, No 4, Jul-Aug 87 (manuscript received 19 Apr 86) pp 561-565

[Article by V.V. Anisimov, V.A. Blinov, L.I. Gedeonov, L.I. Ilyin and V.P. Tishkov]

[Abstract] Monitoring studies were conducted in the Soviet [sic] portion of the Danube and in the Baltic Sea to assess the levels of tritium. Over the period of the study, 1981-1984, the levels in the Baltic remained essentially unchanged from the previous 5-year period: the lowest concentration was noted in 1981, coming to 7.0 Bq/liter for the year, and the highest -- 7.8 Bq/liter -- in 1982. The mean tritium burden of the Baltic Sea for the period in question was calculated at 1.97×10^{17} Bq, assuming a water volume of 2.13×10^{13} m^3. Elevated tritium levels were noted in the Bay of Riga, approaching occasionally 17 Bq/liter, and in some of the rivers flowing into the Baltic Sea (Narova, Pirita, Daugava, Neman). The average value for the Bay of Riga was 12.6 Bq/liter for 1981-1984. Tritium pollution of the Danube was two- to three-fold higher than the levels in the Baltic Sea, with an average concentration of 25 Bq/liter. Although tritium levels in the Danube exceed average global levels, the levels in the lower reaches do not constitute a health hazard. Figures 2; references 10: 4 Russian, 6 Western.

12172/13046
CSO: 18410078

UDC 541.15

EFFECTS OF CROWN ETHER STRUCTURE ON RADIOSTABILITY

Moscow KHIMIYA VYSOKIKH ENERGIY in Russian Vol 21, No 5, Sep-Oct 87 (manuscript received 31 Mar 86) pp 437-440

[Article by Ye.I. Grigoryev, T.G. Myasoyedova, S.V. Nesterov and L.I. Trakhtenberg, Scientific Research Physicochemical Institute imeni L.Ya. Karpov; Moscow Institute of Chemical Technology imeni D.I. Mendeleyev]

[Abstract] ESR and mass spectrometric studies were conducted on crown ethers to assess the effects of substituent groups on the resistance of this class of compounds to gamma-radiolysis, in order to better define the thermo- and radioresistance of crown ethers. [18]-Crown-6 (I), dicyclohexyl-[18]-crown-6 (II), and dibenz-[18]-crown-6 (III) were subjected to gamma-irradiation from a Co-60 source in vacuo to yield absorption doses of 320 and 760 $rad \cdot sec^{-1}$. Evaluation of the radiochemical yield of paramagnetic particles showed that introduction of substituent groups resulted in a marked reduction of the yield, with the introduction of the benzene moiety being most effective in this respect. The reduction in radiosusceptibility of the crown ethers was attributed to energy transfer from the polyether ring to the substituent groups that are more resistant to dissociation than the ether C-O bonds. In terms of resistance to gamma-irradiation the three compounds in the study ranked as follows: III > II > I. Figures 1; references 10: 3 Russian, 7 Western.

12172/13046
CSO: 18410078

DESIGN ENGINEERING IN WOOD CHEMISTRY INDUSTRY

Moscow GIDROLIZNAYA I LESOKHIMICHESKAYA PROMYSHLENNOST in Russian No 6, Aug-Sep 87 pp 30-31

[Interview with Yuriy Mikhaylovich Filippov, director, State Institute of Design Engineering for the Wood Chemistry Products Industry, conducted by G.A. Bogdanova]

[Abstract] In view of the decision of the 27th Party Congress emphasizing the increasing importance of design engineering in improving the productivity of Soviet industry, the Institute anticipates that, by the end of the 12th Five-Year Plan, plants designed by the Institute will have doubled the value of their output from the present figure of 170 million rubles. Examples are presented of installations and plants that have been designed by the Institute and that equal the best production plants in the West. Furthermore, special care is taken to ensure that environmental pollution is minimized. The latter involves pollution-preventing features at the new plants, was well as retro-fitting older installations. Finally, automation is given first priority, both to enhance labor productivity and to mitigate the boredom of manual operations. Projections have been made which indicate that, by the end of the current Five-Year Plan, 23 percent of the operations at the wood chemistry products plants will be automated. The latter, of course, is a goal that depends on close cooperation between the Institute on one side, and the production plants and various research establishments on the other.

12172/13046
CSO: 18410079

UDC 630*86:658.310.136.6

PERESTROYKA--CONTINUATION OF OCTOBER'S REVOLUTIONARY ACTION

Moscow GIDROLIZNAYA I LESOKHIMICHESKAYA PROMYSHLENNOST in Russian No 7, Oct-Nov 87 pp 1-3

[Editorial]

[Abstract] According to the new law covering reorganization of national economy, in effect as of 1 Jan 88, various enterprises will become economically

self-sufficient and autonomous but at the same time accountable for all expenditures. They will propose and execute their plans independently, being fully responsible for all economic aspects of their programs. Net income will become the financial source for paying for their projects. Only general guidelines and long-term projections will be provided from above. State contracts will be aimed only at more important products and will not cover 100 percent of potential productivity; contracts with other agencies, consumers, and businesses should provide additional income and orders. Hence, companies must study the markets, improve their products to become competitive and thus capture the buyers. A new pricing system must be developed. In general, an overhaul of the entire system is envisioned, modernization of procedures, administration, and management. Some companies will undoubtedly have difficulties to adjust to these changes. But all such difficulties must be resolved so that the projected goals will be reached.

7813/13046
CSO: 18410179

UDC 541.123:548.52

PHASE EQUILIBRIA AND CRYSTALLIZATION KINETICS OF L-LYSINE HYDROCHLORIDE-WATER SYSTEM

Kiev UKRAINSKIY KHIMICHESKIY ZHURNAL in Russian Vol 53, No 8, Aug 87 (manuscript received 3 Jan 86) pp 799-803

[Article by L.N. Kravchenko, R.V. Vizgert and V.P. Kravchenko, Donetsk Polytechnical Institute]

[Abstract] Single crystals of L-lysine·HCl·$2H_2O$, because of their unique crystalline characteristics, have found application in dielectronics and nonlinear optics. The crystals possess ferroelectric features, with the crystalline lattice containing ordered polar molecules of water in the polarized unit cells. Differential thermal analysis and thermogravimetry demonstrated that the driving force for crystallization may be described by the equation $\Delta\mu/RT = \ln C/C_e + \ln P/P_e$. In the equation, μ represents the chemical potential of the system, C is the concentration of the suprasaturated solution, C_e is the equilibrium concentration, P is the pressure of the saturated water vapor at the temperature of equilibrium concentration C, and P_e is the pressure at the temperature corresponding to C_e. The rate of crystal growth (V), as a function of the driving, is expressed by $V = \beta(\Delta\mu/RT)^r$, where β is the kinetic coefficient of crystallization from solution that is independent of suprasaturation, and r represents the order of the kinetic plot. Plots of $\ln\beta$ vs. 1/T led to determination of the energy of activation of crystal growth since $\beta = \text{const}.\exp(-E/RT)$. The energy of activation for crystallization of l-lysine was calculated at 63.7 ± 0.4 kJ/mole, indicating that growth of single crystals is not limited by diffusion processes occurring in solution, but by surface events on the crystals. Figures 3; references 9: 7 Russian, 2 Western.

12172/13046
CSO: 18410080

UDC 535.34+539.23

INTERACTION OF VALENCE ELECTRONS AND MOLECULAR FLUCTUATIONS IN TETRATHIOTETRACENE IODIDE FILMS

Moscow KHIMICHESKAYA FIZIKA in Russian Vol 6, No 10, Oct 87 (manuscript received 30 Jul 85) pp 1398-1407

[Article by M.G. Kaplunov, Ye.A. Buzyurkin and Yu.G. Borodko, Chernogolovka Department, Institute of Chemical Physics, USSR Academy of Sciences]

[Abstract] One of the unique characteristics of quasi-unidimensional organic conductors is the interaction of valence electrons with molecular fluctuation, which can be followed by changes in IR spectra and provides a basis for the synthesis of organic conductors. However, measurement and interpretation of such spectra requires appropriate single crystals, a factor that poses a problem in dealing with organic compounds. Consequently, an experimental approach was taken which consisted of the analysis of regular IR spectra and those obtained with polarized light with oriented films of tetrathiotetracene iodide ($TTTI_x$) films on a solid substrate. The films were prepared by saturation of TTT films with I_2 vapors under defined conditions. Introduction of I_2 into the TTT structure was accompanied by a 6-fold reduction in electrical resistance (to ca. 10^2 ohm), with the reduction showing an activation energy of 0.05-0.1 eV. Formation of $TTTI_x$ was also accompanied by appearance of new absorption bands, suggesting a predominant $TTTI_{1.0-1.5}$ film. Analysis of the regular and polarized IR spectra before and after saturation with I_2 vapors demonstrated that the fluctuations in TTT were symmetry dependent, and that the 'phonon phase' method was applicable to determining the contribution of electronic transitions and molecular fluctuations to dielectric permeability of the films. Figures 3; references 19: 9 Russian, 10 Western.

12172/13046
CSO: 18410164

UDC 547.852.963.32

4-CYANO-5,6-DIMETHYLPYRIDAZINONE-3 GLYCOSIDES

Kiev UKRAINSKIY KHIMICHESKIY ZHURNAL in Russian Vol 53, No 10, Oct 87 (manuscript received 17 Mar 86) pp 1099-1101

[Article by A.V. Stetsenko (dec), I.P. Kupchevskaya, N.D. Mikhnovskaya, V.Ya. Podlipskiy and N.V. Klyauz, Kiev State University]

[Abstract] As part of a search for bioactive compounds, a series of 4-cyano-5,6-dimethylpyridazinone-3 glycosides were synthesized by the mercury cyanide method [Schmidt, P., and Druey, J., Helv. Chim. Acta, 37(15): 134-140, 1957]. Six glycosides were synthesized and confirmed by a variety

of spectroscopic techniques as to structure: 2-(2,3,4-tetra-O-acetyl-beta-D-glucopyranosyl)-4-cyano-5,6-dimethylpyridazinone-3 (I), tetra-O-acetyl-beta-D-galactopyranosyl- (II), tri-O-acetyl-alpha-D-arabinopyranosyl- (III), beta-D-glucopyranosyl- (IV), beta-D-galactopyranosyl- (V), and alpha-D-arabinopyranosyl- (VI). Each of these glycosides was found to possess antimicrobial activity in agar diffusion tests, with incubation at 37°C for 24 h. Compounds IV, V, and VI were particularly effective against the bacteria tested. References 4: 1 Russian, 1 Polish, 2 Western.

12172/13046
CSO: 18410164

RESEARCH PROJECTS AT CHEMICAL TECHNOLOGY FACULTY OF RIGA POLYTECHNICAL INSTITUTE IMENI A.YA. PELSHE

Riga IZVESTIYA AKADEMII NAUK LATVIYSKOY SSR: SERIYA KHIMICHESKAYA in Russian No 5, Sep-Oct 87 (manuscript received 13 Jun 87) pp 515-533

[Article by Ya.Ya. Avotinsh, V.Ya. Bruner, E.Yu. Gudriniyetse, M.Ya. Dzenis, M.M. Kalnin, O.Ya. Neyland, U.Ya. Sedmalis and S.R. Trusov]

[Abstract] To mark the 125th anniversary of the founding of the Riga Polytechnic Institute, a brief review is presented of some of the current research projects, scientific accomplishments, and trends at the Institute. Beginning with 1975, the Chemical Technology Faculty concentrated on four primary research areas; currently, the faculty concentrates its major efforts in two broad categories: chemistry, technology, and biotechnology of organic compounds, and the physical chemistry and technology of construction materials and coatings. Studies on the organic compounds are conducted jointly with the chairs of organic synthesis and biotechnology and of organic chemistry, as well as with special problems laboratory devoted to the diketones, and with other interested and involved departments. The research program on the construction materials and coatings also encompasses laboratories specializing in glasses and ceramics, the chair of silicate technology, the chair of polymer technology, and the chair of general chemistry as well as more applied laboratories. Many of the studies in organic chemistry have concentrated on the 1,3-indanediones and other 1,3-diketones. Studies on organic semiconductors, commenced with highly purified samples of 2-aryl-1,3-indanediones, were expanded to include other compounds, and resulted in the synthesis of series of organics with strong electrodonor or electroacceptor properties. A detailed classification has been proposed for charge-transfer intermolecular complexes based on theoretical analyses of donor-acceptor interactions. Furthermore, synthesis of nitrogenous heterocyclic compounds led to identification of agents with spasmolytic, hypotensive, plant growth regulating, and other effects. Research in bioorganic chemistry has emphasized structure-activity parameters of proteins, while the emphasis in organic chemistry has been on novel organic analytical reagents. Highly sensitive photometric and extraction-photometric analytical techniques have been developed for aluminum,

gallium, germanium, titanium, zirconium, tungsten, zinc, and palladium. In addition, progress has also been made in a variety of polarographic determinations of metals, including gold in jewelry. Technical developments have also encompassed drying and mixing techniques and instruments applicable to products obtained by organic and microbiological synthesis. The latter developments have provided products that retain their hydroscopic and adhesive characteristics where applicable. Extensive studies are being conducted on various membrane-based electrodialysis and ultrafiltration for the preparation, purification, and concentration of organic compounds and substances. Current emphasis in studies on silicates includes analysis of the physicochemical aspects of silicate chemistry that may be harnessed for production of new silicate and high-melting nonmetallic materials. Biocompatible surgical implants have been prepared from $CaO-Nb_2-P_2O_5$, $CaO-Ta_2O_5-P_2O_5$, and $CaO-Nb_2O_5-P_2O_5$ systems, and insulating materials from $PbO-SiO_2-P_2O_5$ have been synthesized for aluminum and copper alloys. Research in inorganic chemistry involved preparation of KO_2 and K_2O_2 and studies on their reactions, while physical chemistry research emphasized electrochemical and corrosion characteristics of several metals in aqueous electrolytes, synthesis and evaluation of aluminum salt complexes and of metal hydrides. Other projects concerned adsorptive properties of crystalline iron oxides and hydroxides. Metal-polymer systems were also investigated intensively, with emphasis on polyolefin-steel systems in view of corrosion problems. References 238: 237 Russian, 1 Western.

12172/13046
CSO: 18410164

UDC 541.11

STANDARD ENTHALPIES OF FORMATION OF CIS- AND TRANS-PERFLUORODECALINS

Moscow ZHURNAL FIZICHESKOY KHIMII in Russian Vol 61, No 11, Nov 87 (manuscript received 30 Jul 86) pp 2890-2893

[Article by Ye.V. Zhogina, T.S. Papina, V.P. Kolesov, B.A. Melnichenko, M.A. Zapolskaya and I.P. Prokudin, Department of Chemistry, Moscow State University imeni M.V. Lomonosov]

[Abstract] Perfluorodecalin (PFD) is used widely in medicine in form of the mixture of its isomers: cis and trans. Properties of individual isomers have not been adequately studied thus far. In the present paper thermodynamic functions of these isomers were determined: combustion energy $\Delta_cU^\circ = -3497\pm4.5$ and -3477.8 ± 3.9 $kJ\cdot mole^{-1}$ (cis and trans isomers, respectively). From these figures, Δ_cH° were calculated: -3486.3 ± 4.5 and -3466.7 ± 3.9 $kJ\cdot mole^{-1}$ for cis and trans isomers, respectively. It is concluded that the trans-PFD is more stable than the cis-isomer. References 21: 8 Russian, 13 Western.

7813/13046
CSO: 18410178

- END -

END OF FICHE DATE FILMED

10 May 88